Notebook Series -- Notebooks by Edison
Notebook, N-18-07-18.2

This notebook is a continuation of N-18-07-1. It was used by Edison primarily in July-October 1918 in connection with work performed for the U.S. Navy during the World War I. Two additional entries at the end of the book are from February 1920. Many of these notes were probably made at Glenmont, Edison's home in Llewellyn Park, where he was working with James M. Burns, John A. Hanley, William A. Hayes, Sherwood T. (Sam) Moore, and other employees on a series of experiments pertaining to the measurement and detection of sound under water. One entry was made at a lake near Bedminster, New Jersey, with Mina Miller Edison accompanying her husband on the trip. Included are tests with various devices to pick up and amplify simulated submarine noises. Many of the experiments involve microphones constructed with granules of carbon suspended in kerosene or other liquids. Other components employed include brass and rubber tubes, telephone receivers, audions, and many experimental electromotograph (chalk) telephones. One entry describes a series of experiments with water tube resonators. The entries from September and October record a series of experiments with more than seventy different substances tried in electromotographs. The notes from February 1920 form a continuation of these experiments and include a series of experiments with resonators. Inserted into the book are ten loose pages of notes and drawings by Edison pertaining to the same electromotograph experiments. The front cover is marked "No 3." The pages are unnumbered. Approximately 130 pages have been used.

1080 4) 51.8

4) 50.4

12.60

12.95

12.95
12.60
3.5

30 ft 40 c

2 | 1080

12
0

216
1080
1296
0

51.8

250 | 1050

17
0

210
105
0

250 | 1250

1250

1

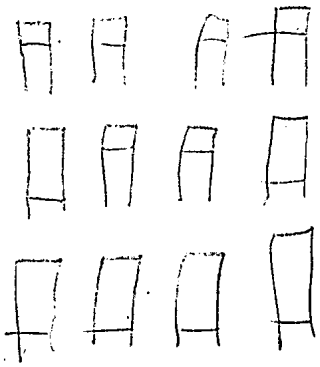
2.25

15.5

256
7
1792

18) 125 (6.9
108
0
172

Adams & Co.,
STATIONERS,
50 JOHN ST.
AND
19 PLATT ST.
NEW YORK.



July 18 1918 –

Continued from Book 2

Experiments with head receiver –
used sand on top of box
no gain –
Used gaskets – no gain –

Best 12 2 Dropping little piece
paper between 300 ft 30 ohm box

We also used stethoscope on this
Head phone & there is no loss
above phone direct against
ear, Either way is OK.

Hanley hears birds sing
phone accurate ft away

We Close the Micro back now + at 325 ft we get it to 4 on box.-

We fill another phone, closed + Reg in Every way - fill with Kerosene this proves more resistance as we get it on box at 6 — when 350 ft away + Cant get it at all on 1st Kero - which is open

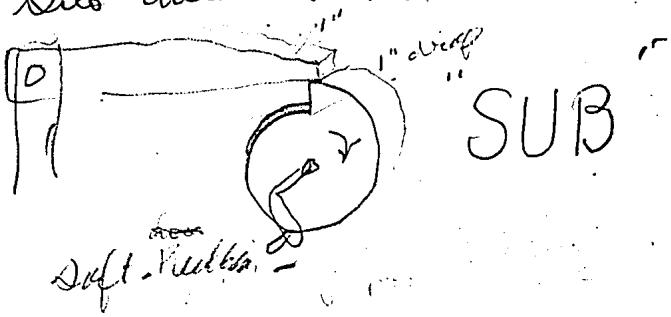
We get it with Closed 1st 2 Kero. 44 on box at 325

No 2 Closed Reg Bell
Mineo - kerosene -
6 of the box is
HIGH WATER MARK
So far ~~or~~ 7.8 times more
sensitive than Bell Magnets.

The noise on No 1 Bro is
8 to E & No 2 is 16 @ 18
No 2 very much noisier
We plugged No 2 myself but
it was just as noisy
showing most of noise
is jar of granules -

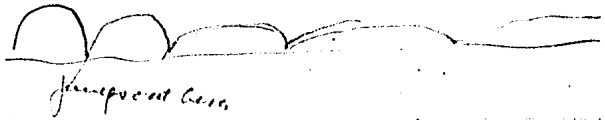
We now adjust No 1 so granule
holder bows closer more to
see how noise changes
While he did it very slight
yet it made No 1 inoperative
So E couldn't get noise

"Sub" imitation in the Cam



Soft Rubber

phonograph of dropping water on Diaphram 2" seems to show that there is only one wave + that the other waves 6 to 8 in number are simply the dying oscillation of the Diaphram



Phonograph trace

of that the Diaphram its echoes from room –

on zero + H we dont get Sub at 300 ft.

These Micros have poor way of adjusting & we get Micrometer adjustment on these we use

Wednesday July 20 1918
2 calls on duty

We now take a 1/2 tube of brass 1/32 wall 4 ft long put Stethoscope at end placed in center of garden with air diaphram at mouth pointing south Burns Twins Sub – Hayes listens to get the limit of hearing 2 30 pm – Sky cloudy only very gentle breeze scarcely any movement of limbs of trees but leaves slightly agitated all over –

Limit 330 ft. under present conditions which is about same as usual –

Notes - Specific Gravity of non Electric Conducting Liquids to be tried in Micro granulator cup -

Heavy Liquids

Acetylene Tetrabromide	2.97
Bromoil	3.34
Bromoform Good	2.88
Carbon Tetra Bromide CBr_4	3.42
" Tetra Iodide	4.32
(Para) Dibromobenzene	2.22
Ethylene bromide	2.19
" Iodide	2.07
Ethylidine Br	2.12
" Iodide	2.87
Hexachlorobenzene C_6Cl_6 solid	2.04
Iodoform solid	4.08
Mercuric Cyanide solid	4.00
Methyl Iodide	2.28
Methylene Br	2.49
" Iodide	3.33
Tetrabromobenzene	3.02
" Ethane	2.97
Boro-wolframate of Cadmium	

See next page

Hanley Confirms this results his limit. They have a quiz-rite pneumatic the general notion -

The above test is with Mica Diaphm in cup same as 17 Hole water phone

Thickness of Diaphm 1½/1000 not specified 1 5/16.

We now take off diaphm & only have the hole ½" dia for air waves to enter

Limit 250 ft Hanley

Harris agree & Beverly also, 2 cells on condition

1.74 times less sensitive than with Diaphm

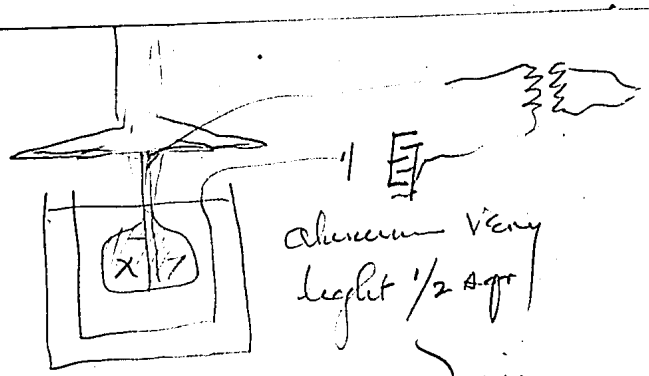
Liquids (Continued) Lighter Liquids

Acetylene tetrachloride	1.58
Methyl Iodide	1.82
Benzene hexachloride	1.87
Benzoyl Bromide	1.57
Benzyl Iodide	1.73
Bromobenzene C_6H_5Br	1.499
Bromoethylene	1.51
Carbon tetrachloride	1.60
" Hexachloride	1.99
Chloral	1.51

In Tetrachloride of Carbon
Bakelite granules from Amer Bell
Phone sent by Friedl,
1/2 floats 1/2 stick Lumpen Cau in
floating particles,
Anthracite granules all sink
Bromoform Both Bakelite
& Anthracite float on Top
Monobromobenzol both Bakelite
& Anthracite sink

All Expts No. 1 2 + 3 book 3 slides

We now put No. 1. Kerosene
Bell & Anthracite granules not used
for 2 days. We now place it
in center of garden on sponges
same as tried it on 18th July
& Plug it to heavy internal
noise — adjustment not
changed — 2 cells on cinders



fixed to dia immersed in Phosphate Soda or least rectifying solution with or without battery X or Condenser or both

Alternating Currents pass from the liquid when p is thrown out of film pore of X aluminum making a vacuum thus lightens the Electrode & is heard when N Comes Water rushes in -

We now use 42 ft of 1/2" 1/32 wall tubing with 1/2/1000 mica on end and in 14ft length test to get distance sound is turned & learn the loss by friction in the longer pipe - = 3 joints - 3 tubes 14 ft each -

Hayes 275
Hanby 275

With & without the Diaphm

This ends direct listening Experiments & gives us all the data we want for the boat apparatus - 1.4 times less sensitive than with only 4 ft with Dia on & 1.7 with it off for some reason 42 ft is better & 1/2 opening or diaphm on its the SAME

*

Note No 1 Receiver has very loud internal noise we noted it on 18th January Receiver leaked out Edison hears to 16 on box Cant hear talking 6" away Except high metallic ring at each word

*

We now start on Expts to diminish internal noises of granules of Carbon in Microphone –

We have put a micrometer adjusting screw with a pointer index so as to adjust the sensitiveness of the phone to known degrees

No 3 is Anthracite carbon used from Jewett July 19 & used partly received,
The granules are immersed in Carbon Tetrachloride,

We adjust sensitive & put into the iron pot plug phone & screw cover down on gasket –

Edison hears to 14 but this is due to very loud snaps at times When not occurring seems to be around 10 @ 12 on box Cant hear Talking

We now adjust in $\frac{1}{1000}$ inch

Edison gets 18 but extra loud snaps gone, only snapy consonants & better — Talking more articulate — grandma was same as came in phone

We now set it $\frac{1}{1000}$ more in making $\frac{2}{1000}$ altogether —

Music just as good 18 & loud snaps -

We now adjust $\frac{2}{1000}$ in more making altogether $\frac{4}{1000}$

big Cracks / Best general as better

Edison gets 14 on already

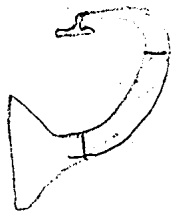
We not set it in .003 more making 007 altogether

No change - less big Cracks

We now adjust in 005 more making .012 $\frac{12}{1000}$

It may be lessening of internal wood is due to deadpening of the movement, only hinge heavier granules & very light liquids wanted by test,

Don't forget line inside base flow with velvet



Kitscraloh Canon

Very little change no bell crackah
Hanley says its pretty tight now so I guess the granules are made too light + are too sensitive,

We make up another phone with 74 Bauxite Gasoline to make granules heavier - even than in Reservoir

Adjusted sensitive — This is much more quiet, has a steady rush very soon, a lip of this is fat fry - Even noise wiped out at 10 for E
Can just hear there is leaking
No cackleckelim on high rate
squeeks very weak Can hear very light
Corner squeek o sheen Scratch sound
after the test tried with dirt burning
Can get 350 ft 30 on box
Cap Hanley -

Best yet while to 28
+ 005 is 32 the
alternating hum here
come in otherwise it would
be at 005 —

We now test the Telephone Cookson 12/1000 adjustable
Hanley gets 350 ft 6 on
box + Sub —

We now set up the Transceiver
005 + (1st adjustment)
and test for sub before
installing in box (plugged)
for internal noises —
Hanley gets 32

We now increase setting up —
005 nets 2 making
010 all together from initial
adjustment — get 28 on box
by Hanley — We now put
back in Potter plug phone —
get alternating note very quiet Edison
leaves it 8 on box

Evidently the lighter the liquid the better as it allows granules to press each other stronger & don't dance so much. The liquid is a sort of a drink pot.

We now set it up one more making 015 which I guess is limit.

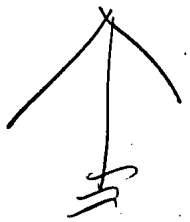
Phenomenon – We put it in pot (plugged) after adjusting to 015 – The alternating hum or whatever it is doubled in strength. + in addition another note perfectly even very much lower in pitch, but couldn't hear any noise at all.

What is the hum?? ???

We now take it out and test for sub + distance. Hanley gets it to 26 on box – Hanley hardly hears hum notes on Zero! The pot seems necessary

So far Anchorage
same as came in the
phones – 74 Bauma
gradient –
Adjusted ~~from~~ 0021
a range of 020 –
Has the least noise
& the most sensitive
+ test yet,

HIGH WATER
MARK.



Specy Metals

Al.	2.583	Thallium	11.85
Sb	6.630	Sn	6.53
As	5.720	Tungsten	18.75
Bi	9.740	" Carbide	16.06
Cd	8.64	Ur	18
C	1.75 to 2.10	Zn	7.142
Graphite	2.10 to 2.585	Zr	4.15
Co	8.718		
Cu	8.910		
Glucinum	1.85 Beryllium		
Iridium	22.4		
Pb	11.34		
Li	0.59		
Mg	1.69		
Hg	13.59		
Mo	8.6		
Ni	8.6		
Os	22.48		
Pt	21.48		
Rh	12		
Si	2.49		
Ag	10.53		
Te	6.015		

July 22 1918

Boiling points & Specy

	Specy	BP
Amylene	.666	36
Butane	600	1
Caoutchene	.650	14.5
Decane (n)	730	173
Di-allyl	690	59.5
Ethylene	687	65
Pentene	700	75@80
Trimethylene	660	21
Heplane	688	98.4
GASOLENE	666@690 (74.3°)	
Heptylene	702 74	98
Hexane	658	69
Isoprene	682	35 to 8
Petroleum Ether	650	70@90
Ethyl Ether	718	34
" Alcohol	793	
Neohexane	649	49.7
Nonane	723	149.7
Nondecane	777	330
Octylene	721	124
Pentane	633	36
Petrol Naphtha	690@700	80@110
Ligroine	730. (23°)	80@120

Sunday July 21 1918

At a lake near Badminster NY
at a Dam, with overflow 3@4 ft wide
possibly 1/4 @ 1/2 thick
falling 1 time

in a gorge = long lake gorge 100 ft wide
Mountains 300 ft high both
sides - trees covered -
Wife heard to 1250 ft could probably
go to 1400, says perfect silence -

We now fix another Micro
with screen adjustment
Using graphite + Backtite granules
sent by Jewett,

First trial very sensitive We
test the aluminate Graphite on
recommendation and get 350 ft
for sub, something wrong
We examine it.

A nut was loose

We get 30 on box by Hawley

To Edison Aluminate Graphite is
about same noise on Zero
but can hear to 16
Backtite Graphite shade less
noise at Zero but only
hear to 10 on box —

We now adjust Backtite Graphite
005 further in —

Note X

The reason we get 34 instead of 30 by setting up making it less sensitive so that the lessened minimal sounds make the ear more sensitive & we hear further notwithstanding the mics is theoretically less sensitive.

X We now get 34 at 350 ft

Edison cant hear beyond 6 on box - Zero very soft, only very few afterthoughts fat fry - BEST YET

We now set it inward 005 more making total inward adjustment 010 -

Hanley get 28 -

Edison cant hear at 6 -

at Zero it is without fat - soft velvet surface

Distances measured by steel tape line —

HIGH WATER
to

This is practically perfect

We now advance the Sub to 375 ft.
Hanley gets 18 on box

We now advance Sub to 400 ft. Hanley gets 4 on box
unmistakeable line of sight

MARK UP
Date
+good Margin of adjustment

On account of insulating ash in idulhracite, the moving of a particle from Contact to a slag section would make a fact fry sound or snap this may be reason Bakelite is best.

It may also be that Bakelite Carbon is heavier than anthracite notwithstanding the ash — also Bakelite is far smoother + absence of very minute points helps smoothness of internal sounds —

Guess real reason is Pot is on ground + gets its tremors where outside phone is on Sponges

Phone inside pot rests on metal of pot.

Phones 2 cells pass about 200 milamp

We now put the Micro in the closed iron pot to measure internal movements of granules

Not so quiet as outside. Micro must have changed adjustment (ie granules moved or some particles got out. Edison can hear to 10 — + Can also hear talking plain — Appears articulate Hanley says it articulate so it may be movements that makes increased noise

Pot is on ground — + naturally gets all its tremors

We now put up the ladder with hose + let the full capacity of hose fall 6ft on top of a wooden box The noise is very great its not continuous but in snaps, irregular + Extremely

Distilled 180 cc of 74 Baume
Grape Cane.
cc 0. Cent Temp
2 38

Sharp & loud by coming
with Sub to within
100 ft Cam head, after
getting used to it Cam
head Sub 200 ft

Edison never heard such
a loud noise from the
water, in Sacramento

This represents it, —
No boat could make 1/5th
of this noise —
Hanley had to
go to 20 on Box

[20]

We now have 3 oz of
Galvalene distilling at
about 95 centigrade
Made by 2 CCC from
74 Be Galvalene —

2 CCC bat
to get it at 200 ft on
account of water too
loud —

With the 2 dynamos —
there is no gain — 20 on box
200 ft.

We now used Nickel reduced by
H, thru 80 mesh on 100 —
put in Micro box in
galvalene, 1 CCC battery
+ 50 Ohms of Rev in
Circuit, to see if worth at
all —
Can't get anything

over

We now crush some of the Bakelite Carbon thru 160 or 180 — but there is some wood splints from screw holder in it which may hurt it — We make up a Ullard cooling Gravity 2 cells on —

at 400 ft 4 on box

Edison hears only to 6 ~~[illegible]~~ rather quiet at Zero for E.

We need set it up 005.

Hanley says same as other to wit 400 ft. 4 on ~~6 box~~

Even if on 180 mesh is as good as the size used by Bill Co is an improvement it is more quiet

If it dont pack after phonograph plays close to say 3 ft for 6 hours it will be OK –

Edison cant hear on 4 – at 2 its weak + zero very little more – By fare best yet for Edison –

NOTE

If no packing takes place Bondite Carbon Item 160 on 180, + probably in Petroleum Ether 50 Cent B Point – 112 Fahr will be the best,

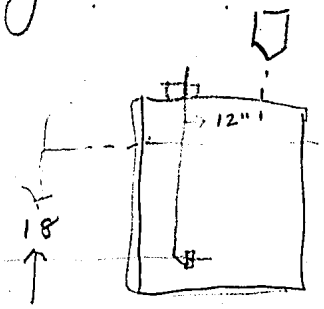
We now Quit Experimenting

with Wires until I get
a supply of Conductive Carbon
to make various grades of
sizes + also loaded with
substance to increase weight
of Carbon granules

We now fix the barrel of
water & Can to test
Reg 1:6 hole mica water
Receiver against
Torsion leverage double
dampen to amplify

Just made by Moore

Pipe on Sponges



1/2" pipe

8 ft brass pipe
6" piece rubber hose
connecting pieces

Using Bell Magneto at 3 volts

Hanley 50 -
Hayes 46 -

We now put in the 2 diaphm
amplifier made by Moore

Hanley 40
Hayes 40

This is very favorable
as the apparatus is not
made properly. well

fix it & test again

July 24 1918

Tried experiments with EMG using Strontium Carbonate 21% KOH.

With Bell Magneto connected to Cylinder phono by 6" rubber tube 3 oz. Large Audion, Handpiece 1500 ohms in CKT I heard to 30 on 60x. Whereas listening to Bell phone as Receiver only heard to 18 on 60x –

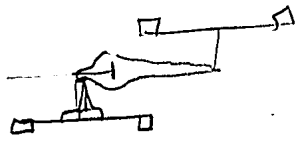
Have small mica phono Reader old style Cup. – Mica Dia 15/1000 –

Oth made a Galah by removing worm + pulling in 3 gears well removes with the morning + put back worm drive

Using stethoscope tube
Cant hear any scratch at
all on horn
Hayes says he only hears
groans.
This looks very promising
for a submarine detector
Can get it reliable - IF

Kisselgur - 15000 ohms
in check ckt heat to 16 on
box - it starts to squeak
when pressure too
much by more KOH
got to 22 on box
but tendency
squeak -
see further on

Moore has fix the lever on 2 diaphm Multiplied so its on a dead line



Hanley gets 60 on boxes
Water drops 6" & hits
water in BGL condition
being same as the previous
test. with the other lever
With Reg waterphone (17
hole) get 60 on box
We now lower the
drop so water only
drops 4 inches

instead of 6, to get back on boxes –

Hanley gets 30
Hayes " 28 out of

We now put Moores model in – water dropping 3"

Hanley 44
Hayes 44

Showing Amplification is going to be a success

Tungstate Calcium Enf—
Takes lots 20% Even
works when wet
with Kott, but got
to 18 @ 20 on 60X
Crumpled — Too soft
must be harder or a
binder — Its promising
This is rejected
Phone, Bell phone Magnido
6" Rub Tube, 15000
Ohms Res

China Clay
Cant get a sound
probably because leaflets
+ no prints —

Rotten Stone
Not a sound

I put in the old Chalk $SrCO_3$
I had made last night
without (setting
got 16 although dried
all night = Wet at touch
Rot. got 36 on box
13 used ones in

Strontium Oxide
Very poor, Crumbles
~~Shows~~ 4 on 60% -
pulls out when wet

Lithium Phosphate
softens up on wetting
poor volume

Bismuth Oxide
Takes Enormous
amount of KOH
poor, Phenomenon

it works at times with
scarcely any pressure
while not at all
with usual pressure
Its white but see
why it is which
except its oxychloride -

Uranah Soda Hydrate
Unlimited in taking
KOH, too cal-
phenomenon is only
works when put balls
KOH on one side but
Chalk holder one side
only something strong

Cadmium Oxide

Very poor, scarcely a round -

Magnesium Silicate, got in illy by Commission found Making -

Cant get a round

track blackens, pbly

Cuts Plain

X This is 8 1/4 % better than Regular

⊗ This is 28.2 % better than old 16 hole Regular

Tests for accuracy of different Water phones

July 29 1918

Reg 1 1/2/1000 - 16 hole - water drop 4" in 6 hrs -

Hanley 28
Hayes - 28 on box

Hayes made another with 3 Holes 002 Mica - Dia 1/2"

X Hanley 32
Hayes 36

No 3 Hayes Complefying with Center button on dia giving 5/16 cent - price drop

⊗ Hanley 40
Hayes 38

3/32 around edge of Dia

(362)

tests of Water phones
July 30 1918

Reg 1½/1000 16 hole
Water drop 4" in 66 ft. Bell
Magnets on 2nd ½" tube
10 ft long 3 large cell
Moore 40
Hayes 40

3 Dia hole 002 mica Dia ½"
Moore 42
Hayes 44

Moore Amplifier
Moore 42
Hayes 42
Center button ¼"

July 31, 1918

Same tests over again after Moore hardened & fixed up — he used 1/4" center pieces on the 3 samples

Req 1½/1000 16 holes 4" Strip of water —

Moore 40
Hayes 40

3 Holes 002 mica ½ dia

Moore 45
Hayes 50

Moore Amplifier 1/4" center balls 002 mica — Re-assembled

Moore 40
Hayes 40

Made 3/4" dia 5 holes 1/4" dia
1 1/2/100 mica Drop water 4'
wet test -

Moore 42
Hayes 40

Moore again - bit Mica
005

Moore 44
Hayes 46

Moore again 009 1/2

Moore 42
Hayes 46

Note

July 31 1918

Chalk phone —

W Va Limestone Dontwork

Lithograph stone Nothing

Native Silicate Magnesia (?) Nothing

Aluminum Hydroxide

Very smooth, it cracks when wet, but works ok

Several cracks due to shrinkage Limit

30 on 60x Band

Music 3 stage Bell

phone connected to

phone by 6" Rubber

tube 15 ohm 3 stage Amp

This is very promising & several should be made to try deformed strengths KOH NaOH, Li & other solutions —
Could mix the $AlOH_3$ with Stronalia only Light pressure required
Great Merit is Smoothness

The Chalks Could be wet with KOH before moulding

Lithopone, only 6 @ 8 on box —

Tungstic acid. KOH
attacks it 4@6 on box
which it turns
Can only use ~~[illegible]~~ with
acid + other solutions.

Strontium Oxide -
account 16 on box
takes only little
KOH, -

Tried the old Rhodia
been cost 3 or 4 days
Report but only 16 on
box

Aug 2 1918

Magnesium Ammonium Phosphate Baked Moist with slight amount KOH to neutralize

Got 8 on box flakes —

Sodium Antimonyate Not a Dozen

Barium Antimonate takes unlimited KOH at times strong goes bad then wet stages then hard acens and of a coral pelargin of platinic oxides at times 10 on box

Queer?

Silica - softened with KOH, then baked

12 on box

a quick with heavy press

Fe_2O_3 from igniting
Oxalate. - Baked
8 on box - bad surface
tends to squeek on
heavier pressures

Blank Fix
$BaSO_4$ -
7 or 6 x squeeks
Cracks -

Note

Aluminum hydroxide - powdered
heated at 212 before
moulding its load but
cracked in two before
could recover -

Aluminum hydrox no
water - no KOH.
Baked 5 hours at
212 - pressed 500 alm
Cracked but accurate

Al Hydrox no water
no KOH. not baked
500 almos Dont Crack
20 on box unbroken
Try LiOH KOH various strengths
NaOH - 500

Mixture Alumina Hydrate
& Strontia Carb.
Equal parts by
weight — not dried —
12 oz box

Cylinder turned
from Potash alum
No round.

Aug 5 1918

Nickel Oxide from roasting
Oxalate moist with
Sodium Silicate
Baked
Rough bad -
8 on box bad
irregular - squeak

*ferric hydroxide —
Cant get a sound

Calcium Hydroxide
8 on box
takes up lots
KOH — over track

Aluminum Hydroxide prepared into
cylinder 500 cc using no
water or KOH, then heated
212° for 3 hours then heated
300 @ 350 1 hour — Cylinder
cracked, powdered it +
again placed 500 cc no water
or KOH - 26 @ 28 on
box —

Moore amplifier
all knife 2 stages –

3 holes 002 Reg – 1/2 – dia
Moore gil 4
Hayes 50

Moore 002 – 5/16 including
1/2 –
Moore 42 –
Hayes 42

Not yet it yet

Cadmium Hydroxide.
Just hear on Zero -

Lead hydroxide
(Can't hear a sound)

Mercuric hydroxide
Its weak on Zero yet
hear to 12,
Phenomenon lightning
the precedence the decrease
it is — an explosion
all others —

Tes Lucelick dont

Good

Bismuth hydroxide
Has peculiarity I have
noticed in others
Will hold only when
scales are wet through
paraffin probably
Insoluble = get too
much KOH -
Try others.

Magnesium hydrox
30 on box good
probably 32 -
Wont stand much
KOH - if too much get
soft -

Zinc hydroxide
26 on 60x –
Wont take excess KOH
softens –

Stannous hydroxide
No sound
Cylinder softens
With Dry [illegible]

Aug 7 1918

All swells up 11 9
no sound

Cupric hydroxide
Not a Round

Cobaltic Hydrox
probably 4 to 6 on
Cox-plan —
Busted

[54]

Ferrate of Barium
Decomposed a sound
only at times

Manganese hydroxide
Mg
Nickel

Carb Strontia
LOEt with NaCarb
only 10 on box
added KOH, only
12 on box

Carb Shooting
1st wet Arsenite dado
only 4 @ 6 on box
afterwards KCN
only 10 on box

Carb Shooting
wet with 500 Silicate
Dilu + 45 cc Water
only 4 to 6. wet
with some KCN
get 8 @ 10-

Carb Strontia
Sodium Monosulphide
8 on box – when
wet KOH! 16 on box

Carb Strontia
Sodium Hyposulphite –
8 on box – after
KOH, 16

Carbonate Strontia
KCN – poi –
after KOH
30 on box

Carbonate Strontia
Sodium Borate,
8 @ 10 —
after KOH 28 —

Carb Strontia
Sodium Peroxide
Sat Sol —
4 on box to the
KOH 28 on box

Carbonate KOH
w Borax —

Now test with
Mg hydroxide
" } with
$SrCO_3$

def percents of KOH
NaOH, LiOH,
Caustic OH, + let the
test all round

	on Box	
Kissolghur	22-	
Carb Strontia	30	
Ca Tungstate	15	
Strontium oxide	16	Crumble
Aluminum Hydroxide	30	
Mg NH4 phosphate	8	
Silica Potassa	10	
Fe_2O_3 "	8	
Magnesium Hydroxy	30	
Ca Hydroxy	8	
Mercuric Hydroxy	12-	Can use V bright pa
Zn Hydroxide	26	Explosive

Carb Strontia
KOH only -
Don't [illegible] 12
Don't [illegible]
this -

We again resume expts with Osmion - Sept 13 1918

3 stage, Bell p 1300 [illegible]

Test phone gives 16 on box

---

1 Magnesium hydrox made by Eckman Bell 16 28 on box

---

2 Magnesium Sulphite No sound. dont take up but little KOH, then pull out —

---

3 Chromic Hydroxide appears fair but crumbles Cant get test If made with KOH & then wash chalk with water might do

CGOI

4 Magnesium Phosphate
Bell 16 — This only 12 on box

5 Magnesium Oxalate,
on 4 — Neg
should be made with KOH softener not
with Carbon

6 Magnesium Hydrox (No 2)
only 20 — dont take up
but little KOH, shows
tendency to flake

7 Magnesium Citrate.
12 on box — softens
bad but by letting soak &
dry a little got 12

8. Magnesium Acetate
dissolves No Sound

9 Nickel Ammonium Sulfate –
Dal No Sound –
KOH Dont go in –

10 Copper Carbonate
seems work good absorbs
KOH OK – good track
NO Sound Bellquasi 6

11 Litharge –
works good, takes up large
quantity KOH, track OK
Not a sound

12 Lead phosphate
hardly hear anything
Bell 16 - works good otherwise

13 Calcium ferrocyanide
takes up considerable KOH
get 28 on box!
Bell 16 -

14 Red Oxide Mercury
works ok get 22
on box

15 Lead Sulphate
Bad cylinder but
works ok no sound
Bell 16

16 Colloidal Fe_2O_3
Mucks all up
No sound - Fred said
it turned like a metal
in long chips ? ?

17 Iron by H.
just heard it - Scratches
also lead - squeek

18 Barium Hydroxide
2 on box

19 Light Calcined
Magnesia
26 on box

20. Magnesium fluoride
30 on box.
its very strong to 24
then falls Loose
Smooth Notice
& Cracked Colour KOH
put on way across

21 Calcium Citrate
Softens up tears

22 Zinc Oxide -
12 on box

23 Calcium Sulphide
6 - greedy of KOH

24 = Strontium Salicylate,
Decalcifying Bone take
KH.

25 Sprue Berate,
takes up only little port
quess 8 on box

26 Strontium Oxalate.
38 on box
Bell 14 mixing
Crack (1e) shrinks but
keeps hard,
Expect with this.
Mould + soak in KOH before
turning off + stop crack,

27 Magnesium Carbonate
12 on box

28 Barium Phosphate
10 on box

29 Calcium Arsenate
26 on box
Crucible Cover not
left — Exact
Very low on
shelf (No box)

30 Calcium Oxalate
32 on box
Very low on shelf

31 = Calcium Sulphate
2 oz box Cont
Take KOH but little

32 Chromate of Calcium
20 oz box

33 Zinc Carbonate
Nothing
20 oz Bottle —
Don't use only
Trace KOH.

34 Calcium Iodate
Powders Dried

35. Lead Nitrate
Dunham, NY

36 Potassium Permanganate
Squeeze 10 on box
Unseen around top

37. Strontium Sulphate
4 – [illegible]
[illegible] to squeeze

38 Manganese Dioxide
Dunham

39 Ferrous Phosphate
14 on box

40 — Magnesium Borate
8 to 10 dollars
up 100 pounds.

41 — Black Antimony Oxide
April 16 1918
Bdl 16 = 28 @ 50 on
box. it cracked some but
ok

42 Strontium Peroxide
28 on box

43 Aluminum Hydroxide
24 = Chemical Sponge
in Crocks 2 Cases
Crocks — handles

[10]

44 [illegible] Carbonate
[illegible] 2 [illegible]
powders [illegible]

45 [illegible]

[illegible] - [illegible]
[illegible] -
[illegible]

47 [illegible]
[illegible]

48 - Barium Borate.
14 -

49 - Copper oxide.
Ball 20 - not very loud on Zero but goes to
32 on box
Aint improves much by heavy pressure
works on light pressure.

50 - Magnesium formate
12 on box

51 Magnesium Ethylsulphate
Dissolves

52 Calcium ~~Silicate~~ Silicate 55
34 - Very loud at Zero -
Takes Enormous KOH. takes 5 or 6 times 1 cc - also it works at first while Mercurial lost.
After activation with KOH + 10 pounds of track goes 20 on box

53. Blackoxide Manganese
Bell 18 Rough —
No Sound

54 Manganese Carbonate
Rough No Sound

55 Lead Peroxide
Rough No Sound

56 - Iron Sulphide
Rough No Sound

57 Barium Arsenate
Bell 18 — 8 — only take
a little KOH —

58 Zinc Sulphate
Barely near on
Zero of Box

59 - Strontium Ammoniate
20 on Box

60 — Strontium Arsenate
20 acts
Quiet gets loud then
gradually weak +
music sounds like it
was jumped out

61 – Manganese Borate
14 – Dont take
hardly any KOH

62 = Nickel Citrate
Dol NG

63 Cobalt Sulphate
Soluable

64 Calcium Silicate
30 @ 3Z Dup
Odd quer. slope
then that again as
OR – Dquick note
apparently fm phono

After 1/2 hours
[illegible]
Looked worthless

65 Iron Carb ?
~~Just [illegible]~~
~~No Sound~~
2.60x

66 Nickel Oxalate
No Sound

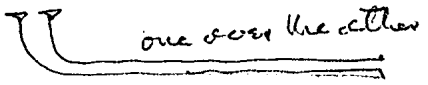
67 Lithm Carbonate

68 Retrial
Nickel Oxalate
Cracked NG

Sept 17 - 1918

* Little Sub Knocker used before

Experiment with 2 brass tubes ½" inside 50 ft long - with holding cup for water phone but no perforated plate or diaphram



Hayes hears Sub thru air -

When listening with stethoscope Each tube separately gets limit at 220 ft -

When listening with a single Separate tube to each ear from each brass tube hears it at 360 ft.

The squares of these distances of stethoscopes 2 tubes 2.7 times more sensitive than a single tube

Its 68% more distance allowing for loss of sensitiveness of diaphrams hence if we heard boats at 700 yards then with double tube we should hear them equally as well at 1150 yards -

67 Lithium Carb all day
Bell 18 lost weight H_2O got 6 or 8
on box ?

69 = Benzidine Sulphate
No Sound

70 = Amidophenol
No Sound
Don't take KOH.

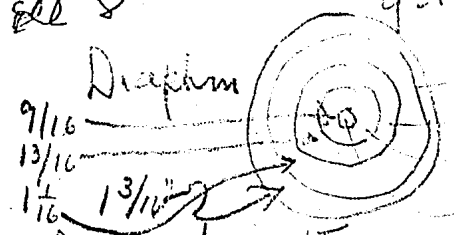
71 Anthracene (CP)
No Sound
Don't take KOH

72 = Amidophenol Hydrochloride
No Sound

73 Naphthalene
No Sound

Oct 3rd
Bell 9 - Edison has cold
Carb Shoulea 18

Bell 8 got 28



Much better as
it allows more fraction
of pressure

Bell 8 — get 28
Carb Strontia new dia —
020 —
When the other Check
plume in series.
get 24 on box —
Zero in Multiple
get. 26 — not
much diff.

new Dia 020 Ct 4 500 at
Calcium Oxalate
Bell 12 —
Edinburgh — 30 on box —
Cracked Longitudinal

500 at
Bell 12 — Strontia Oxalate
30 —

020 diaphragm
Calcium Delicate
Bell 12 26 500 at

Copper Oxalate
28 —
Has more density than
the others — 750 at times
Volume poor on Zero

Strontia Carb (500 at) Trial
40 hours ago removed + put
in general Bottle, bottom working
Carb here to 6 on box —
Wet a little get 30 @ 32 on
box

Bell 12

Oct 8 1918
Oxalate Shrouded -

Bell 12 — 32 -
Acoustic gas Bred. - 750 atmos

Single 7/16 tubes 50 ft long
Pdg Haynes water cooling

001	Mica	heavy Sub	300
0015	"	"	300
002	"	"	300
003	"	"	280
004			260
005	"	"	235
006	"	"	210
007			—
008			—
009			190

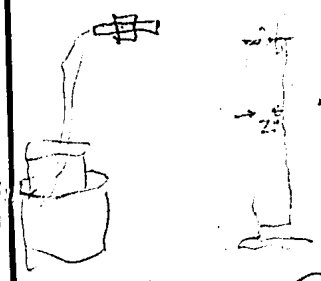
with 2 tubes 7/16 internal Dia -
0025 (2 3/4 long) heard 500 ft -

Oct 29 1918

Experiments with Water Tube Resonators 2" dia 1000 cc glass -

Using Middle C small Tuning whistle 2" long 3/8 dia with Reed - ~~Blown by~~ by cash Coin gas chamber -

The whistle has Column in Resonator No 1 15 1/2" air column & No 2 15 9/16 Column



Were not Tuned Exactly
flowing to 6 1/2" from whistle through listening tube, beat

volume ~~[illegible]~~ resonator ~~[illegible]~~ to
Tuned to fundamental 15 1/2"
E heard to 21" away

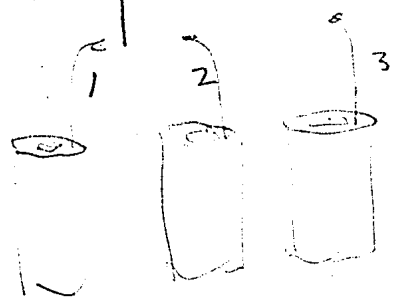
C701 D

Thus by the square law makes amplification 12 times

Put the two Resonators off 150 ft from C Hayes says much louder these tubes than direct also intermitting whistle makes it more conspicuous also that Simpson running fore 75 ft away on lawn circuit around that the noise of auto was very much cut down by tubes, only 1/3 of what is w/ by direct Ear —

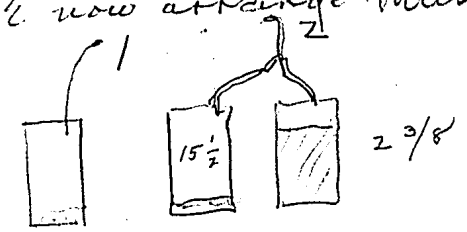
We are bothered very much by wind blowing across Resonator half sounding its note, & will surround it with a tent open at the top to see if we can stop it — This is OK

While the fundamental is 15 1/2". The only other sound is at 2 3/8, which is a 7th =



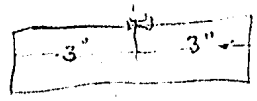
1 & 2 are fundamental notes 15 1/2"
No. 3 is 2 3/8 as column —
~~No.~~ 1 & 2 are louder when listening in their tubes than 2 & 3 —

We now arrange thus



and find on listening to 1 & then to 2 that 2 is louder & outside noises & sounds audible around is less than in 1 — The quality is fuller & more like the original ym and quality & loudness

We had a battery jar 6" diam 11" deep but closed not found any tone not deep enough for fundamental & too wide for ym.



2 3/8 — under these conditions impossible to get 2 3/8

Were the jar 16" or 18" the fundamental 15 1/2 would probably be louder than with 2" CC was

We now have 4 more glass jars 2 tuned to fundamental of C & 2 to ym —

150 ft away uncertain which

is the loudest fundamentals pinched off or ~~the~~ pinched off all on, all on seems to be loudest, 150 ft to close

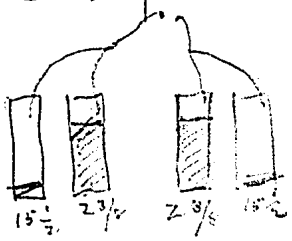
We now move the tent & Rasmussen a long distance, 775 ft ~~[illegible]~~ or 150 ft about beyond hearing direct with ear. Ras put in tent to keep wind from blowing across mouth of Ras & mouthing Coleman cornet

These experiments so far show the utter improbability of a man with good ears detecting delicate changes Even big changes in the Volume of sound. The only way is to find the limits of audibility for each change

406

~~Yesterday~~ we heard ~~550~~ ft direct by ear ~~[illegible]~~

With fundamental 15 1/2 & overtone tube 2 3/8 @ 2 1/2 for one listening tube



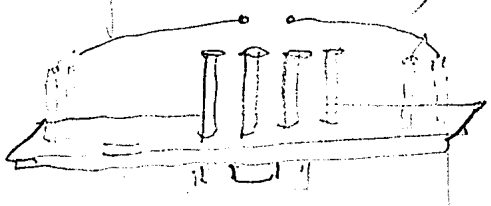
We hear plenty a distance of 775 ft - Even when the ford is 25 ft from listening tent and on line now, We admit the C tube - Hayes thinks he dont hear ford on tubes but Hum has heard earlier

When Recumbent & Y were talking 150 ft from C Coleman Hayes heard whistle - & says he could hear

still farther, this is at least 250 ft beyond the limits of hearing by Ear direct.

After we reach the limit of audibility - take jars to C & time for open end tube & try -

Make turn table to put the 4 jars on to get best direction,



4 ft

Make a brass tube say 6" dia & 32" long for fundamental -
Think we have one jerry made up in Garage.

Oct 30 tests today - moved tent across glen - Distance now 1090 ft - Good to about limit. Day rather quiet some wind but more noisy than yesterday - We estimated sound 1 1/2 per second so we make it far more easy to recognize amidst the other continuous sound.
On Return I find the 4 Res are not so sensitive as I thought ~~about~~ fundamental not as strong as 4th - both together don't seem any louder except at times. This may be due to difference in blowing as the overtones increase in Volumes more than fundamental when harder blowing

(82)

I put 2 Rec both tuned to 7th
+ found 2 in unison
Very much louder than one
alone —
I then put 4 tubes all tuned
to 7th by [illegible] were
in [illegible] [illegible]
greater complication [illegible]
of listening tubes I heard it
untouchable 31 miles
The best [illegible] 20
miles —

This is a point,

This should give 1635 ft instead of 1090

Proposed new ones
~~Strontium~~ Silicate,
Aluminum "
Magnesium "
Barium
Zinc
Cu. Fe, Mn, Tin,

Aluminate Calcium
" Strontium
Barium
Iron
Zinc
Tin
Cadmium
Copper

Arsenate Calcium
Magnesia
Zinc
~~Strontia~~
~~Barium~~
Tin
Cadmium
Copper

S

Recapitulation to this point

	Oxbox
Kieselguhr	16
Tungstic Calcium	20
China Clay	0
Rotten stone	0
I Strontium Oxide	4
Lithium Phosphate	poor
Bismuth Oxide	Poor
Uranate Soda	poor
Cadmium Ox	poor
Magnesia Silicate (Native)	0
W Va Limestone	0
Silicate Magnesia (Native)	0
Aluminum Hydrox (mix of alids not hydrox)	+ 30 +
Lithopone	6
Tungstic Acid	5
Z = Strontium Oxide	16
Magnesia Ammon Phosphate	8
Sodium Antimoniate	0
Barium "	10
Silica	12
Ferric Oxide, (ignited Oxalate)	8
Blanc Fix	2

Slip Al hydrox $SrCO_3$	12
Cylinder turned from K Alum	0
Nickel Ox (ignited Ni oxalate)	8
Ferric Hydroxide	0
Calcium Hydroxide	8
Cadmium Hydrox	1/2
Lead Hydrox	0
Mercuric Hydrox	12
Magnesium Hydrox.	+ 30 +
Zinc Hydrox	+ 26 +
Stannous Hydrox	0
Cupric Hydrox	0
Cobaltic Hydrox	5
Ferrate Barium	0
Manganic Hydrox	0
Magnesium Sulphite	0
Chromic Hydrox	— Crumbles
Magnesia Phosphate	12
Magnesia Oxalate	4
Magnesia Citrate	12
Magnesia Acetate	0
Copper Carb	0
Litharge	0

Lead Phos	0
Calcium Ferrocyanide	+ 28 +
Red Oxide Mercury	+ 22 +
Lead Sulphate	0
Colloidal Ferric Hydrox	0
Iron by Hydrogen	0
Barium Hydrox	2
Light Calcined Magnesia	+ 26 +
Magnesia Fluoride	+ 30 +
Calcium Citrate	Crumbles
Zinc oxide	12
Calcium Sulphide	6
Strontia Salicylate	dissolves
Ferric Borate	8
Strontium Oxalate	— 38 —
Magnesia Carb	12
Barium Phos	16
Calcium Arsenate	+ 26 +
Calcium Oxalate	+ 32 +
Calcium Sulphate	2
Calcium Chromate	20
Zinc Carb	0
Strontia Fluoride	10
Strontia Sulphate	4
Ferrous Phos	14

Magnesium Borate	9
Black Stannous Oxide	+ 28-30 +
Strontia Borate	+ 28 +
Alumina Chromate	+ 24 +
Bismuth Sub Carb	2
Ferric Oxalate	0
Bismuth Oxychloride	0
Zinc Oxalate	8
Barium Borate	14
Copper Oxide	+ 32 +
Magnesia Formate	12
Calcium Silicate	+ 34 +
Peroxide Manganese	0
Mangan Carb	0
Lead Peroxide	0
Iron Sulphide	0
Barium Arsenate	8
Strontia Antimonate	20
Strontia Arsenate	20
Mangan Borate	14
Nickel Ox	0
Lithia Carb	6
Benzidene Sulfate	0
Amidophenol-p-	0
Anthracene	0

Amidophenol. Hydrochloride 0
Naphthalene 0

Feby 12 1920

Having made a large supply of the best cylinders I start again Experiment on Chalk phone

1st Thing found out that the Cotton fibre brush we use for washing the Cylinder makes a Colloid by action of the Alkali This caused colloid to remain on surface while KOH goes in and we are always working on the Colloid and not the mouth of the pores of the Chemical

We then cut a piece of fine pore Rubber Sponge and used that instead but we should have heated it in 20% KOH to get excess sulpher & other impurities out,

The 3rd thing I found that our pens with Palladium plate resting on Top of Cylinder & pressure rubber never

Cooperate except by chance to get loudest reproduction —

for instance with a light Calcium Oxide of Magnesia & got nothing whereas on removing pressure rubber & having finger for pressure, got it quite loud but had to press one side & not direct down —

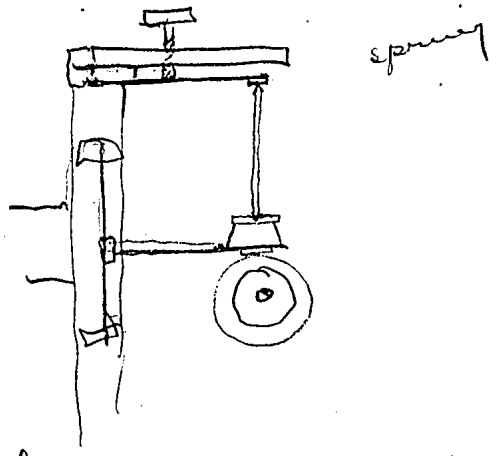
We are making an Universal joint pen to see if it will always fit & direct down pressure give even results.

Another thing I inadvertently have been using 20% NaOH instead of 20% KOH.

Feby 16 1920

The Universal joint NG —

put old wide 3/16 pen back & changed Ulius



This is best yet, got with Carb strontia 12 on box

Think can enormously improve this keeping $SrCO_3$.

When the pen mechanism is OK think can get 20 possibly 30. As far from the right device to get full efficiency

30
30
900

900) 2743 (3.04
2700
43 00

5225
5225
26125
10450
26125
27431 25

4) 1090
272

1090
816
190 6

36

600625

164836

164836) 600625 (3,6
494508
106117

165000) 1000000 (6.
990000
10000

3396720

21
21
21
42
441
36) 36 (1
87
9

3) 3470.
1733
25
5665
2266
2832 5

8-to much-

20
8
60

1/2-

775
406
369

2/1090
545
1635

4—16
16

164000 | 1.188100
1148000
000 | 7.2

1890
1090
9810
1090
1.1881 0 0

775
775
3875
5425
5425
6025

1.188100
1148000
401.000

406
406
2436
1624
1648 36
369.00

[ITEMS(S) FOUND IN BOOK]

Cant hear Bell.

Reg Stronalin 8 — 750 ohms
Reg Stronalin 8 strong 1000 ohms
but tendency to squeak

Calcium Silicate 6 - 1000
not quite up to 6 -

Calcium Oxalate 7+8 1000
think this is more even
Volume than above
but squeaky takes lots
sodi —

Strontium Oxalate Zero hear 1000
Little Rattler Chain when only little Mg

D. Ithacene CP Nothing 500

[ITEMS(S) FOUND IN BOOK]

(2)

We now chang width of
pallidum from 3/16 to
[illegible] 1/16 -
fend it - precocacy
2 on 60 x hrs later -

Light Centaurea
Magnesia just heavy 4 300 ~~CH~~
Breath doesn't seem any tracheal
flow - cough of Bicht

Light Calcarea Mg 6 to 7 600 ~~CH~~
Smooth - Very -
takes KOH 20% Very slow 3 days.
take 2 or 3 min to slow

Light C Mg 6 slightly 800
New York

[ITEMS(S) FOUND IN BOOK]

Light Calcined Mg 4 1200 ct
700 pressure Great for this

Oxalate Zinc 4 — 800

Cobalt Oxalate, Nothing 800
Boutreak in decomposes to
Blue hydrox —

Manganese Oxalate MC
Decomposes —

Copper Oxalate X 800
Boutreak to decomp — it could
not take KOH —
boutreak in —

(1)

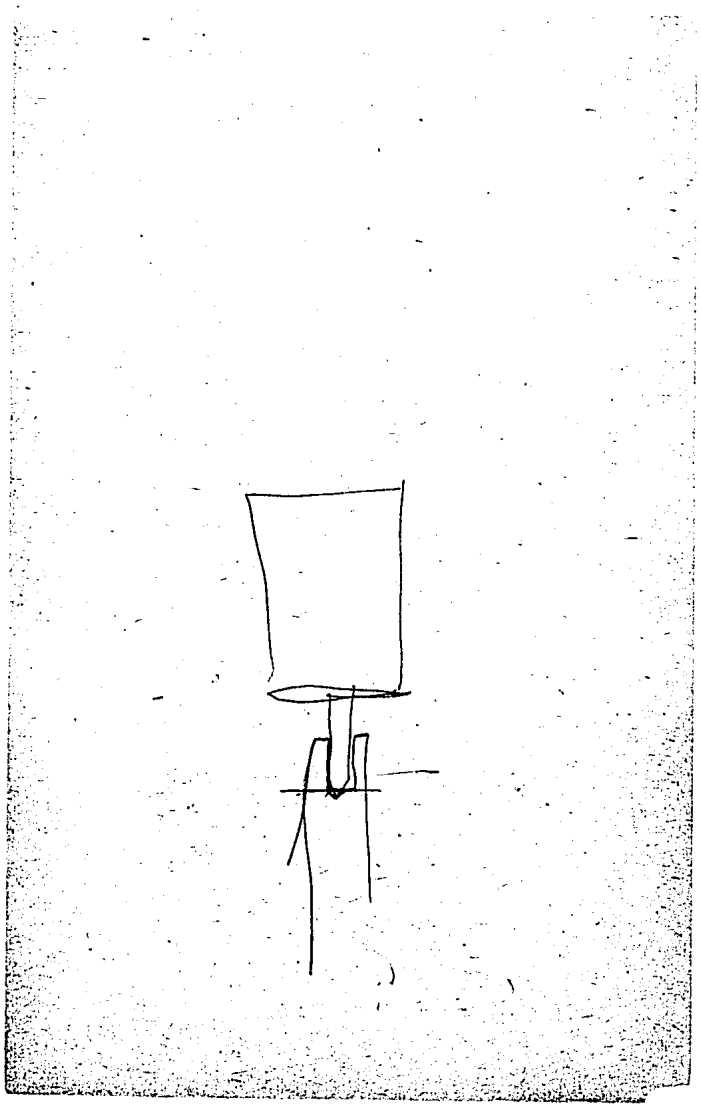
[ITEMS(S) FOUND IN BOOK]

Stannous Oxalate X 800
don't soak in —

Reg Stroulia substituted
a 2200 ohm Bell for
Reg 100 ohm bell for
Random don't improve
it very much I think
its reasonable to 2200
cos I get to 10 on box
probably because
high voltage —
Think will make
this standard

(42)

[ITEMS(S) FOUND IN BOOK]



[ITEMS(S) FOUND IN BOOK]

I will now put in a standard Stew Stronta
tree beet Can do —
2200 ohm Sender Bell —
I get 10 on box
the very limit but only
at times hear it

Oxalate Calcium 1000
lbs ——
2200 Res Bell Sender
This seems unreliable
Either with 3/16 point or 1/16
put + variable amounts
both strength
At times loud on Zero
but I cant hear it
all on box + yet

(5)

[ITEMS(S) FOUND IN BOOK]

once I heard it at 10 –
but generally only 4
it takes 2 or 3 times
as much KOH as
Carb Strontia & generally
the other cylinders –

I think I have just found a
Bug in all previous Experiments
When I use organic matter
in brush for coating
for instance Cotton, the
alkali attacks Cotton
& the stuff comes off
as a Colloid, the KOH
in soaking in the
chalk etc cylinder

[61]

[ITEMS(S) FOUND IN BOOK]

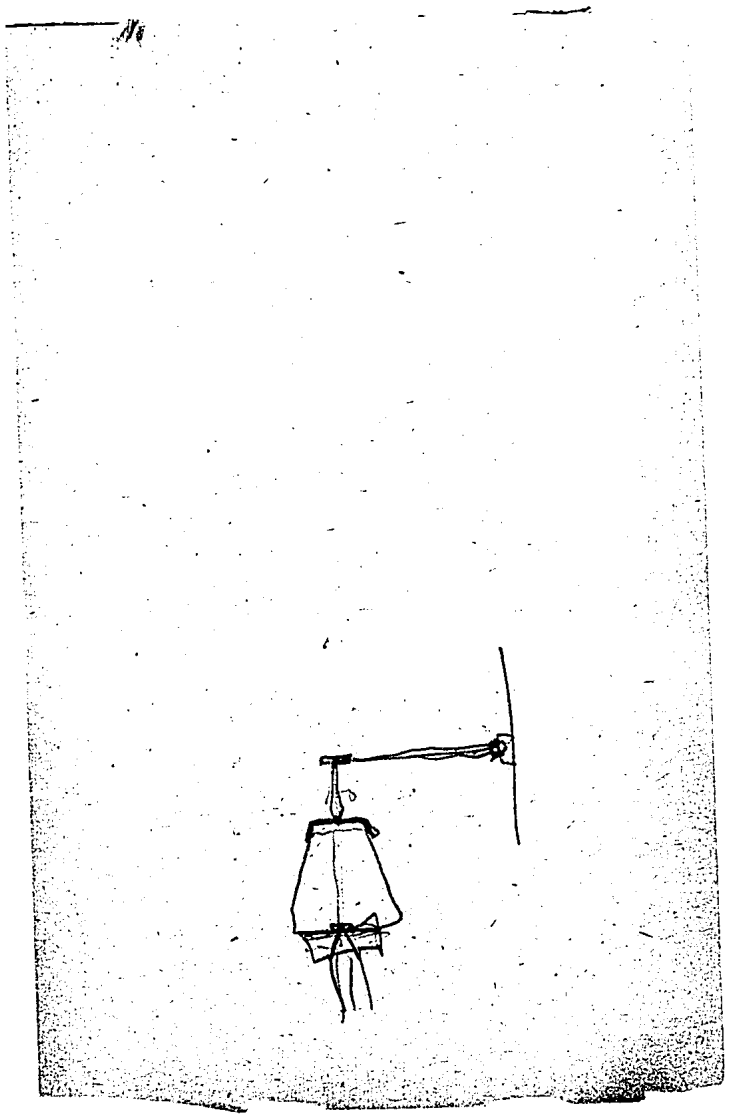
leaves all the Colloid on
the surface & we really
are not working on the
material the chalk.
is made of but always
on the Colloid, The more
we wet it the thicker
the deposit gets, I
am now trying rubber
sponge also thin sheet
rubber 3/8 of which is cut
in threads & bunched to
gether to form a sort
of a Brush -
Tried it - it works ok
but results no better
as I must boil the
Rubber, to get Sulfur out etc.
fine rubber sponge wholly
sponge

[C1]

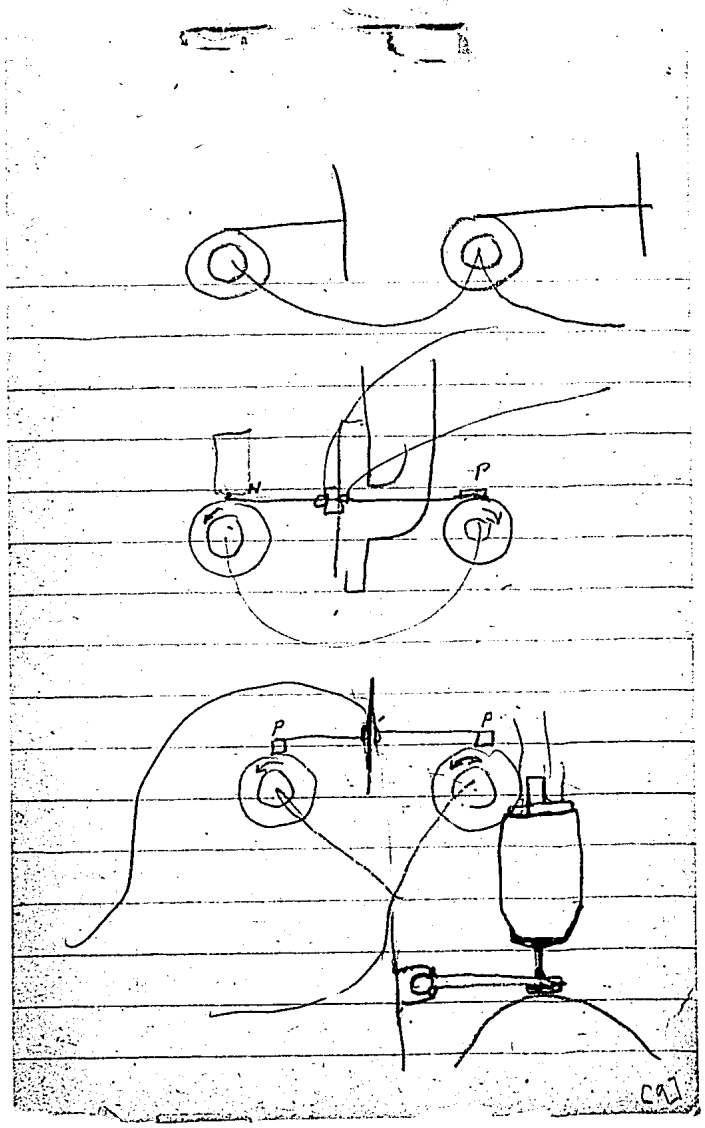
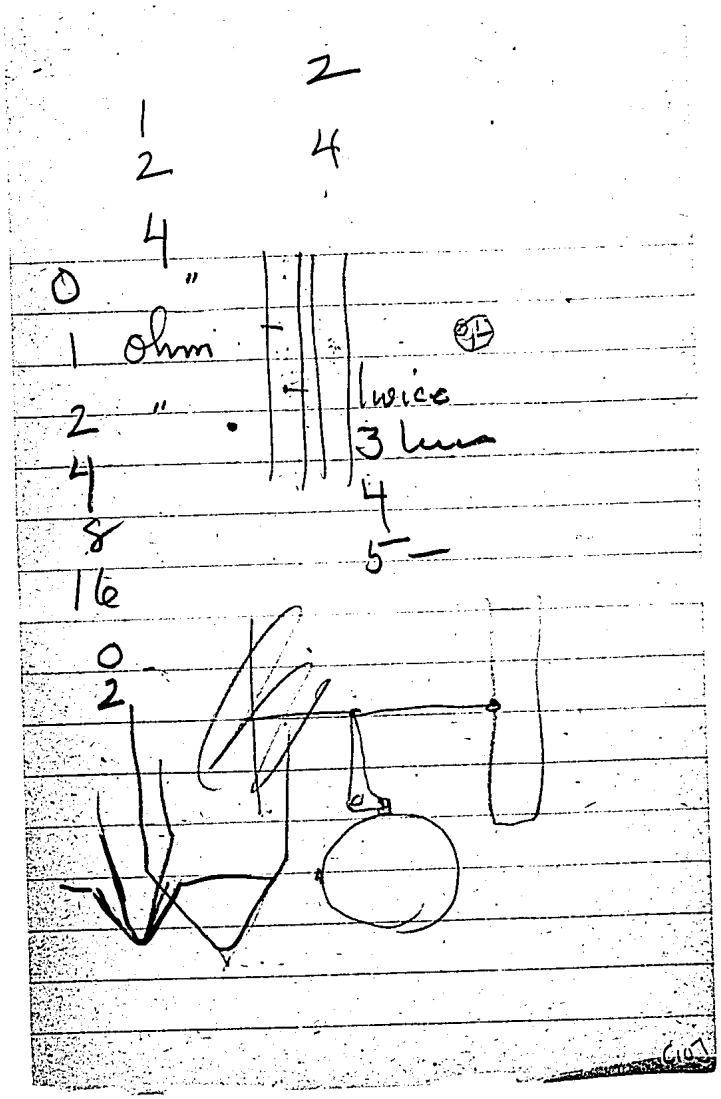
[ITEMS(S) FOUND IN BOOK]

I find another bug
used Calcined Mg - couldn't
get anything on Zero
took out pressure rubber
used finger pressing
to one side came
loose - This lever
never been right
will now make Universal
joint in it connection
to diaphm so palladium
plate will always
press on chalk flat,

[ITEMS(S) FOUND IN BOOK]



[ITEMS(S) FOUND IN BOOK]



[ITEMS(S) FOUND IN BOOK]